2016 Annual Report

from the

Integrated Watershed Research Group

at the

University of Northern British Columbia

submitted to

Nechako Environmental Enhancement Fund
Project Manager: Dan Boudreau

Prepared by Barry Booth, Research Manager,
in conjunction with
Drs. Déry, Owens, Parkes and Petticrew

Report 3 of 4

February 15, 2017

General Project Introduction

The University of Northern British Columbia (UNBC) houses an Integrated Watershed Research Group (IWRG) comprising: Stephen Déry (Environmental Science Program), Philip Owens (Forest Renewal BC Chair in Landscape Ecology), Ellen Petticrew (Forest Renewal BC Chair in Landscape Ecology), and Margot Parkes (Canada Research Chair in Health, Ecosystems and Society). These researchers have worked collaboratively for several years on integrated watershed-based research with an emphasis on the Fraser River Basin and other northern BC watersheds including the Nechako River Basin (NRB). The researchers view integrated watershed research as linking biophysical, chemical, social, and human-health processes to address important environmental, landscape ecology, and community issues. This group has begun a four-year research program in the NRB comprised of three foci that address specific questions.

1 – Water security and climate change (Déry and students): Is a warming climate leading to more or less surface water availability in the NRB? What is the impact of anthropogenic versus natural influences on the basin's water resources, including streamflow amounts and timing?

2 – Sediment sources and dynamics (Petticrew, Owens and students): Fine-grained sediment has been identified as one of the main concerns within the NRB, and some key questions are: Where is the sediment coming from? If we identify the sources of the sediment, can we implement watershed management strategies to help control these sources and limit their detrimental effects? Given anticipated future changes in climate and land use in the watershed, how will sediment sources respond to these changes?

3 – Tools for integration in watershed management and governance (Parkes and students): How do decision support tools such as watershed report cards, indicator frameworks, and tools to integrate spatially referenced watershed information feed into broader processes of watershed management and governance? How do we build capacity for developing, managing and maintaining decision-support tools that integrate health, ecological and socio-economic parameters to inform watershed management and governance? How do we better understand the relationship between these decision-support tools and ongoing watershed-based science, given their different timelines, orientations and processes?

Timeline

The IWRG at the University of Northern British Columbia was awarded a $500,000 contract from the BC Ministry of Forests, Lands and Natural Resource Operations via the Nechako Environmental Enhancement Fund (NEEF) in late March of 2014. This contract was backdated to January 6th, 2014 since the IWRG-NEEF discussions regarding the project contract had been under discussion since September 2013, and the initial proposal indicated a January 2014 start date.

The following represents the work we have accomplished in 2016.

Overall Project Management

Development of research office:

- We continue to collate documents and existing knowledge (published reports, journal articles, books, etc.) pertaining to work in the Nechako River Basin. These documents will feed directly into Theme 3.
- We have developed a website for the IWRG (http://www.unbc.ca/integrated-watershed-research-group/research/nechako-river-basin) that features work done under the auspices of this research program/grant.

Presentations, meetings, and extension:

- Presentations, meetings , and outreach with potential project partners:

  - Barry Booth attended the Cumulative Impacts Research Consortium (CIRC) meeting in Vanderhoof on April 6th, 2016 on behalf of the IWRG to provide background information relating to research in the Nechako to meeting participants as well as to contribute to the CIRC process;
  - Barry provided much needed assistance during the sturgeon spawn in Vanderhoof at the Nechako White Sturgeon Recovery Centre (NWSRC) on May 24th, 2016. This visit coincided with a meeting with SD 91 staff (Theme 3 related work).
  - Barry was the 'tour guide' for the Lieutenant Governor's Stewards of the Future Conference (http://www.ltgov.bc.ca/lg/priority-programs/stewards/default.html) field trip from UNBC to the NWSRC on June 4th. Barry presented background information relating to the status of white sturgeon in BC, the rationale for the construction and operation of the NWSRC, and current research being conducted in the Nechako River watershed (Appendix 1).
  - Barry, and Kate Hewitt, MNRES student, travelled to Cheslatta Lake on July 15th, 2016 on behalf of the IWRG to attend the signing of the Framework for negotiating a Reconciliation Settlement Agreement between Cheslatta First Nation and BC.
  - Stephen Déry, Phil Owens, Ellen Petticrew, and Barry provided an update of research to date to the NEEF management committee, August 24, 2016;
  - Barry, Kate, and Phil participated in a workshop organized by Steven Conrad, SFU entitled: Amalgamating local data to inform water related decisions workshop: Nechako Watershed, November 25, 2016.

- As part of the collective contributions of the IWRG, we also continued our collaborative work with the Nechako Watershed Roundtable partners, both from a project and a governance perspective, in ways that complement efforts across all three themes. Our work in this area included the following:

  - Stephen is currently acting as UNBC's representative on the core committee of the Nechako Watershed Roundtable (Barry is his alternative);

- Barry is also currently a member of the Technical Advisory Committee with the Nechako watershed strategy, that is being developed by the Fraser Basin Council in conjunction with the Nechako Watershed Roundtable;
- IWRG hosted a Nechako Watershed Roundtable Meeting at UNBC on June 23rd, 2016 that provided an update on the Nechako Watershed Strategy.
- IWRG co-hosted the launch of the Nechako Watershed Strategy at UNBC on October 13th, 2016. Details of the launch can be found here: http://bit.ly/2icWUG3

Theme Updates

Theme 1: Water security and climate change (Déry , staff and students)

We have made tangible progress on climate research in the Nechako River Basin (NRB). Our progress so far is summarized below.

Reports published and in press:

- In 2016 we have submitted three documents for publication. Two papers were accepted for publication, while a third is under review.

  Published papers:

  Sam J. Albers, Stephen J. Déry & Ellen L. Petticrew (2016) Flooding in the Nechako River Basin of Canada: A random forest modeling approach to flood analysis in a regulated reservoir system, Canadian Water Resources Journal / Revue canadienne des ressources hydriques, 41:1-2, 250-260, DOI: 10.1080/07011784.2015.1109480

  Ian M. Picketts, Margot W. Parkes, and Stephen J. Déry. Climate change and resource development impacts in watersheds: Insights from the Nechako River Basin, Canada. The Canadian Geographer / Le Géographe canadien. doi:10.1111/cag.12327

  Paper under review:

  Marco Hernández-Henríquez, Aseem Sharma and Stephen Déry. Variability and trends in runoff in the rivers of British Columbia's Coast and Insular Mountains". The manuscript was submitted to Hydrological Processes in early 2017.

Field work, data collection and analysis:

- Aseem Sharma continues to work on his proposal for his PhD and will defend this proposal in the winter semester (January to April 2017);

- We have secured additional funding from the Real Estate Foundation of BC Partnering Fund to support Mr. Aseem Sharma. Aseem will be examining the effects of atmospheric rivers (AR; aka Pineapple Expresses) on extreme flooding events in the Nechako River Basin and how the incidence of ARs has changed over time. Progress on this work has included the following:

    - Collected meteorological and reanalysis data for ARs landfalling in coastal BC including the Nechako River Basin. These datasets will be used in performing a climatology of ARs in the region;
    - Performed exploration and collection of atmospheric reanalysis data for ARs and the research is ongoing.
    - Identified and listed the dates on which the ARs arrived in coastal BC, the process of analysis is ongoing.
    - Preliminary analysis on the role of ARs as they arrive in BC and their contributions on extreme snowfall/rainfall events in the Coast Mountains of BC is ongoing.

Research extension and outreach:

- We worked on sharing climatological information on Nechako to our fellow IWRG colleagues, local communities and stakeholders, and at an international conference:

    - One June 23rd, 2016 Stephen, Aseem, Marc Howard and Julia MacGillivray travelled to Tatuk Lake to participate in a science camp organized by Cindy Lauze from Evelyn Dickson Elementary School in Vanderhoof. Stephen's team discussed research that is being conducted in the Nechako with emphasis on weather and climate change with 45 students from grades 4-6.

    - Aseem presented and participated in 2nd annual International Network for Alpine Research Catchment Hydrology (INARCH) in Grenoble, France during October 17-19, 2016. This provided an opportunity to share the status of hydro-climatic data availability and use in the Coast Mountains of BC. Furthermore, it provided an international academic platform to highlight our research activities in the region.

    - We have contributed for Nechako watershed data portal by providing, data, maps and sharing ideas with new Master's student Joseph Gothreau.

Theme 2 – Sediment sources and dynamics (Owens, Petticrew, staff and students)

Reports published and in press:

- In 2016, we had one paper accepted for publication. Please note that this citation is also included in the Theme 1 update. We also have a second paper in preparation.

Published paper:

Sam J. Albers, Stephen J. Déry & Ellen L. Petticrew (2016) Flooding in the Nechako River Basin of Canada: A random forest modeling approach to flood analysis in a regulated reservoir system, Canadian Water Resources Journal / Revue canadienne des ressources hydriques, 41:1-2, 250-260, DOI: 10.1080/07011784.2015.1109480.

Field work, data collection and analysis:

- Continued to work on research related to sediment sources in the Nechako Watershed:

  - Dr. David Gateuille, Post Doctoral Research Associate at UNBC (2014-2015) from France has been analyzing data collected in 2014-15 and providing synthesis of this work;
  - We processed and analyzed the remaining suspended samples collected in the 2015 season for total metal analysis;
  - We sampled suspended sediments (SS) within the mainstem of the Nechako in proximity of Vanderhoof during 2016 for future SS metals analysis. These samples will be processed and analyzed in early 2017;
  - We expanded our fingerprinting analyses to include polycyclic aromatic hydrocarbons (PAHs). These samples were analyzed by a commercial laboratory (Maxxam) in 2016;
  - We collected suspended sediment samples during the cleaning of the sturgeon spawning beds in summer of 2016 in conjunction with Northwest Hydraulics. These samples will be analyzed for trace metals;
  - In addition to collecting suspended sediment from the cleaning of these beds, Barry and Todd French, UNBC Research Associate, provided field assistance to Northwest Hydraulics during the cleaning of the beds;
  - We received funding from Real Estate Foundation of BC Partnering Fund to examine the presence of persistent organics pesticides (POPs) and polychlorinated biphenyls (PCBs) congeners within the same creeks we are currently working on, as well as depositional areas along the river's main stem. This project will augment our fingerprinting work and will also provide potentially valuable information regarding watershed health to our community partners. These samples were analyzed in late 2016 and early 2017 by a commercial laboratory (AXYS);
  - One of the cores collected in 2015 by Barry, Phil, Leticia Gaspar, and Kristen Kieta was prepared and processed by Richelle Sussbauer for grain size analyses, and fallout radionuclide content (e.g. cesium-137), the latter at the University of Manitoba (one of the other cores was analyzed for fallout radionuclides, geochemistry and particle size in 2015);
  - We have contracted the services of the UNBC GIS Lab to collect, collate, and scan historical air photos in the Nechako basin. This work was done by undergraduate student Nick Taylor under the supervision of Senior Lab

Instructor, Scott Emmons. This project will augment our fingerprinting work by providing insight into how temporal changes in land use in the Nechako basin may have affected sediment delivery to the river and consequent floodplain sedimentation patterns (as observed in the collected and analyzed cores).

Research extension and outreach:

- We worked on sharing sediment related projects in the Nechako to our fellow IWRG colleagues, local communities and stakeholders, and at a national conference:

  - Phil presented preliminary results of sediment fingerprinting research at the Canadian Water Resources Association conference in Montreal on May 25, 2016. The work in the Nechako was also part of a fingerprinting technical workshop that took place at the same conference;
  - Phil and Ellen presented research results to the Upper Fraser Fisheries Conservation Alliance (UFFCA) on June 16, 2016 to update the UFFCA on progress being made by the overall project, with emphasis on sediment work.

Theme 3: Tools for integration in watershed management and governance (Parkes and students)

We continue to develop and trial a spatially referenced watershed portal tool to create a platform to bring together, share and profile existing knowledge and new watershed research. Progress for this theme continued to focus on design and collaborative activities required to develop and test new tools to integrate and share information in the watershed. The development of this theme has been directly informed by the projects described in Theme 1 relating to climate change and resource development in the Nechako and will continue to be informed by the research and results emerging from Theme 2. In addition, we continued to work on watershed governance through our activities with the Nechako Watershed Roundtable. It should be noted that Theme 3's activities, in part, overlapped significantly with Theme 1, including the collaborative work linked to the publications noted above (Picketts et al. 2016).

One major development with our theme is that we have welcomed Joseph Gothreau as a new Masters student. Joseph will be co-supervised by Margot Parkes and Stephen Déry. Joseph's research will examine the effectiveness of the portal as a tool to facilitate knowledge exchange, to promote discussions about the implications of climate change, and to identify options for creative climate solutions in the Nechako watershed that address climate change implications for ecosystems and well-being. Joseph is learning JavaScript to allow for more in-depth work on the web-portal. He has also applied for Pacific Institute of Climate Solutions (PICS) Fellowship to support his graduate work.

Reports published and in press:

- In 2016, we had one paper accepted for publication. Please note that this citation is also included in the Theme 1 update.

  Published paper:

  Ian M. Picketts, Margot W. Parkes, and Stephen J. Déry. Climate change and resource development impacts in watersheds: Insights from the Nechako River Basin, Canada. The Canadian Geographer / Le Géographe canadien. doi:10.1111/cag.12327

Field work, data collection and analysis, and technical development of portal:

- Technical progress on portal:

  - We are maintaining and expanding Zotero library of published resources and materials relating to the Nechako watershed. This includes regular searching for articles, reports, etc. through Google Scholar and other search tools. This Zotero library is the central storage place for managing items before they are submitted into the portal;
  - Portal 2.0 data has been loaded reflecting varying types of information for catalogue materials (such as research documents) and spatial information. Data loaded to date include ~350 + submissions. Primary research literature in the Nechako has been set as the priority to load and to date, more than 150 articles have been loaded. In addition, we have loaded ~ 200 other submissions including reports, videos, and newspaper articles. This approach of defining a process of gathering and loading of materials has provided procedures around how data are gathered, stored and shared via the Portal. This has also contributed to design specifications for the next version of the Portal (Portal 3.0);
  - New data are being loaded into the Portal, and data loaded into the previous version of the Portal (Portal 2.0) are now being transferred to the new model. This process requires the database migration from one system to another. Initial testing of this migration of smaller databases has proven successful. With this in mind the Zotero submissions (around 250 research materials) are now being migrated and tested. The next steps will be to migrate this and other portal sites to the newer version.
  - Portal 3.0 is now in the Beta stage. There is a working version of the Portal with substantial improvements on design, functionality and expandability. This is a map centric, web-based interface that provides methods to dynamically create forms and to accommodate a variety of spatial layers. We are now in the testing and training stage of Portal 3.0.
  - Kate has had eight meetings with the Cheslatta Carrier Nation (CCN) on matters relating to both the portal and her thesis work. This included a formal meeting

between Chief Corrina Leween and Kate, along with Margot and other members of the IWRG team. This effort resulted in a letter of support for Kate's work from Chief Leween.

- We have a signed Community Research Agreement (CRA) with the CCN, and Kate has also received full Research Ethics Board approval for her own thesis work in the area, titled: Exploring Indigenous – Led Collaborative Stewardship in a Watershed Context: Perspectives from the Nechako Headwaters.
- Work with the CCN has resulted in the early stages of styling for a version of the portal that the CCN will adapt for their use in archiving and profiling information they wish to share.

- Development of partnerships with portal user-groups, for future refinement and applications of the portal, includes:

  - NEWSS and School District (SD) 91.
    - As with the CCN, we are working with NEWSS to develop and sign a CRA. We expect this to be finalized and signed in 2017.
    - We are continuing our work with NEWSS and SD 91 on how students from this district could work with NEWSS on collecting both ecological data (e.g., riparian health, water quality, etc.) and personal stories to help enhance community engagement in NEWSS' work, and how UNBC's watershed portal could act as a means to display/host these data and stories. More generally, we are exploring how the portal could be used by students in the planned experiential learning curriculum in SD 91 across a range of grades/ages and disciplines including: ecology/biology, digital and visual arts, and information technology. A main component of this project was to bring together the resources of the teachers and administrative staff of SD 91 together with the resources of the Pacific Streamkeepers Society (http://www.pskf.ca). Our goal was to train one teacher from a high school in Vanderhoof, Ft. St. James, Burns Lake and Fraser Lake so that students in each of these communities could conduct streamside assessments using the methods of the Pacific Streamkeepers. To this end we completed the following:

      - Barry and Wayne Salewski (NEWSS) selected locations for training sessions;
      - Barry worked with administrative staff of SD 91 to arrange for teachers to attend training sessions;
      - The IWRG brought up Zo Ann Morton, Pacific Streamkeeper trainer, to come to Vanderhoof to conduct a two-day training session with Barry and SD 91 staff;
      - Following the training session, Barry worked with Zo Ann to post data on the Streamkeeper website;
      - Barry will continue to provide follow-up support for SD 91 staff who attended training, with the expectation that a concerted sampling effort will commence in 2017;

- We are also working with the UNBC GIS lab to have Streamkeeper data loaded into UNBC watershed portal.

Research extension and outreach:

- Margot participated as a convener and panelist in an EcoHealth in Action Webalogue Series on May 25th, profiling and exchanging the portal work with national and international researchers in a panel session titled: " *Integrative approaches to environment, community & health: Innovations and connections across local, Indigenous and geospatial knowledge".* See https://ecohealthkta.net/integrative-approaches-webalogue/
- Barry participated in a field trip organized by Patty Borek from W.L. McLeod elementary school in Vanderhoof on June 23rd. Barry assisted in the examination of health of the riparian ecology of Stoney Creek with students from grade 3.
- We have worked on the development of related collaborative proposals informed by the work of the IWRG and watershed portals, including development of a pan-Canadian effort for an "Environment, Community, Health Observatory Network" (ECHO) for consideration for funding by the Canadian Institute of Health Research. We received notification that the ECHO project will be fully funded, with research work commencing in 2017.
- Barry, Joseph, and Kate attended Watersheds 2016 workshop in Vancouver, October 1st and 2nd. Kate and Joseph act as note takers for this workshop, and Kate presented a poster of her research project.
- Margot, Scott Emmons, Joseph, Kate (UNBC) and Theresa Fresco (NWR), participated in a discussion on Oct 26th, with colleagues from New Zealand, Alaska and Canada, in a follow-up from the Webalogue Series on May 25th. The focus was "Integrative, geospatial, and Indigenous-led approaches to environment, community & health issues." This group agreed to meet on a quarterly basis throughout 2017 for further interaction and exchange among projects on these themes, including as the CIHR-funded ECHO project develops.
- Joseph presented a poster at a UNBC Graduate student showcase event, December 2nd.

Integration and collaborative work

- Part of our work with NEWSS and SD 91 pertains to the collection of data relating to streamside restoration (see above). As a part of this work, we have begun discussions with a range of people and organizations with the goal of developing a community-based monitoring program in the Nechako. This work has been informed in part sending Barry to the North American Lake Management Society conference (November 1st and 2nd) to explore the topic of community-based monitoring (CBM) and how a CBM program could be initiated in the Nechako. Upon return, he has been in discussion with the following people/organizations to determine the present status of CBM in the Nechako, what resources exist, and what plans are being formulated:

- Celine Davis, Kristen Heslop, and Phillip Krauskopf, Ministry of Environment
- Michelle Tung, UFFCA
- Dawn Roumieu, BC Lakes Stewardship Society (BCLSS)
- Krista Kaptein, Caretaker Network Coordinator, Important Bird & Biodiversity Areas (IBA) Program, BC Nature.

- We also continued our collaborative work with the Nechako Watershed Roundtable partners, both from a project and a governance perspective, in ways that complement efforts across all three themes. Our work in this area included the following:
  - We co-hosted the launch of the Nechako Watershed Strategy at UNBC on October 13th, 2016. Details of the launch can be found here: http://bit.ly/2icWUG3
  - Throughout 2016 Stephen continued to act as Core committee member with the Roundtable, with Barry acting as alternate. From 2017, Margot will return as UNBC's representative on the NWR Core Committee.
  - Barry continues in his role as member of the Technical Advisory Committee of the Roundtable

Appendix 1. Letter from Lieutenant Governor to Barry Booth

Lieutenant Governor of British Columbia

June 20, 2016

Mr. Barry Booth
Research Manager
Integrated Watershed Research Group
University of Northern British Columbia
3333 University Way
Prince George BC V2N 4Z9

Dear Mr. Booth:

It was so good to see a familiar face at the conference. Your participation made the history of the Nechako very vivid and encreased their understanding of the river. Thank you for sharing your considerable knowledge with the students and helping them as they start their journey as Stewards of the Future.

The Conference was such a success thanks to the kind donation of your time and efforts. It was so very rewarding to see the students enjoy themselves as they learned about sustainable resource issues and how they can be addressed. I look forward to learning from them as well, as they continue their lifelong studies and do their best on behalf of the environment and the land that sustains us.

Again, thank you so much for your participation in the conference. Due to your care and efforts, the next generation of Stewards are off to a great start as they make their mark on our shared future. Your kindness is very much appreciated.

Yours sincerely,

Judith I. Guichon

The Honourable Judith Guichon, OBC
Lieutenant Governor of British Columbia

Government House 1401 Rockland Avenue Victoria British Columbia V8S 1V9